stationed at Taylor, Tex., in order to deliver lectures at the University of Texas, located at Austin, which is about 30 miles southwest of Taylor, reports:

I have called upon President Prather of the University of Texas. As Mr. Alexander Deussen is now giving three lessons a week in elementary meteorology it appears most feasible to let the present arrangement stand for the remainder of this college session and for me to arrange to deliver a few lectures to the students as a whole on the U. S. Weather Bureau and its work. It is believed that such lectures would be helpful as matters of general information and would serve to bring the course in meteorology more prominently before the student body.

Mr. W. S. Belden, Section Director, Vicksburg, Miss., reports that during May and June he delivered a series of five lectures before the junior and senior classes of St. Francis Xavier's Academy on the following subjects:

(1) Temperature and pressure of the atmosphere.
(2) Winds and moisture of the atmosphere.
(3) Atmospheric optics.
(4) Cyclones, anticyclones, hurricanes, and tornadoes.
(5) The weather map and weather forecasting.

The lectures were freely interspersed with experiments and illustrations.

THE NEW EDITION OF HANN'S METEOROLOGY.

The great demand for the Lehrbuch published by Hann in 1900–1901 has given occasion for the preparation and publication of a second edition, of which the first five parts have already been published by C. H. Tauchnitz, in Leipsic, Germany. So far as we have noticed, the illustrations and charts of the second edition do not differ materially from those of the first; indeed there was little occasion for a change in this respect, except in regard to the results of the more recent observations of hail and clouds, or the international work with kites and balloons in the free atmosphere. On the other hand the text shows everywhere the revising hand of the author, introducing innumerable changes in order that it may represent the latest additions to our knowledge. The historical development of observational meteorology has been given so fully in the first edition, and especially in the standard Lehrbuch by E. E. Schmidt (Jena, 1860) that Hann has rightly appreciated the fact that the great need of the present moment is a clear statement of the physics and mechanics of the atmosphere, that is to say, the problems of heat, moisture, and motion, and the rationale of the never-ending complexity of our atmospheric phenomena. Although Hann has made statistical climatology such a prominent part of his life work as to have revolutionized our knowledge of the subject, yet he has been able to devote equal attention to the underlying philosophy, and step by step has built up a systematic theory or in some cases has completed the structure that others had begun. His second edition differs from the first by the omission of many bibliographical notes in fine print and by the use of larger type for the main body of the text, it is therefore much less wearisome to the eye and it is easier to follow the trains of thought. If the preceding edition was an encyclopedia or a compilation of all that the author had read during his preceding forty years of activity, the new edition on the other hand is a digest of the present condition of our knowledge, and, therefore, especially adapted to the use of students in universities and of teachers who give special attention to meteorology.

The English speaking public has often asked for an English edition of the original German work; in fact the Editor undertook this work with a brave heart, but after a few weeks realized that we could find no publisher for it, and that in fact those who are able to use such a translation are probably also well enough acquainted with the German language to prefer the original. But as regards the present edition, which will embrace about 600 pages as compared with the 800 of the previous edition, there can be no doubt but that an English translation will be welcomed by students and teachers throughout the world. It is greatly to be hoped that by assigning each chapter to some competent student for translation the German publisher may secure the most prompt publication possible, so that this work may exercise throughout England, America, and their colonies the good influence that it is bound to exert among the German speaking peoples.

So far as published the new edition consists of an introduction of 24 pages; Book I, pages 25–125, five chapters on the temperature of the solid and fluid portions of the earth's surface and of its atmosphere; Book II, pages 126–156, four chapters on atmospheric pressure and its variability; Book III, pages 157–275, four chapters on the aqueous vapor of the atmosphere; Book IV, pages 276–362, five chapters on the movements of the atmosphere or dynamic meteorology. Book V, the disturbances of the atmosphere, or the daily weather, storms, cyclones, etc., brings us to the last page, 432, of the fifth part. This corresponds closely to page 542 of the first edition and shows approximately the ratio of condensation in the two editions. Evidently the omitted bibliographic notes in fine print have often been replaced by additions of new material. At this rate one more part will bring us to the end of the volume, at something more than 600 pages.

As the price of the new edition, unbound, will amount to about eighteen marks or $4.50 when complete, it will be quite within the means of every college library and enthusiastic teacher. Either Stechert or Lemcke and Büchner, the well-known importers in New York, N. Y., will obtain copies at the shortest notice. But, as above said, an English edition is imperative. No one can ask that another with the genius of Hann shall repeat the great labor that he has performed for the science to which his life is devoted. Rarely has any branch of science presented a similar instance of 50 years of continuous devotion of every energy of one person to the herculean task of bringing order out of chaos; throwing the light of reason upon the art of observing and studying one special line of natural phenomena. Most meteorologists, so-called, have divided their attention between that subject and some other branch of science, but Hann has from the beginning devoted himself to meteorology alone.

CONTRIBUTIONS TO THE PHYSICS OF THE FREE ATMOSPHERE.

The great extension that has been given to the use of balloons and kites in aerial research is well known to all readers of the MONTHLY WEATHER REVIEW. The work of Abercromby with the kite balloon in 1885 and 1887, Teisserenc de Bort with sounding balloons about 1887, the Weather Bureau and the Blue Hill Observatory with kites about 1894, has led this subject to be taken up by almost every nation of Europe, and it is seen to be the most important branch of atmospheric investigation. By voluntary agreement on the part of individuals and national weather bureaus certain dates have been agreed upon for simultaneous ascensions and the results of this work have been published in greatest detail at the expense of the German Government in a series of volumes known as "Veroeffentlichungen," or the "Publications of the International Commission for Scientific Research by means of Balloons, Kites, Mountain Stations, and Cloud Observations." Four volumes of this character have been published for the years 1899–1903, but as it did not seem proper that Germany should bear the whole expense of the international work it has been agreed that beginning with the work of 1904 the publication shall be at the joint expense of all nations and individuals that are willing to contribute to it. Accordingly contributions and subscriptions may be sent to Prof. H. Hergesell, Strassburg, Germany, as president of the international committee.

A publication distinct from the preceding was initiated in 1904 under the title of "Beiträge," or "Contributions to the

Physics of the Free Atmosphere." This publication is especially designed to include the general investigations in this branch of meteorology as distinct from the publication of the original data of observation. Three parts of the first volume have already been published under the editorship of Professor Hergesell, and, as before, subscriptions may be addressed to him at the University of Strassburg. The contents of these three parts have already been mentioned by title in the lists of "Recent papers bearing on meteorology," published in the MONTHLY WEATHER REVIEW, but the following detailed notices may not be superfluous:

(1) *H. Hergesell.*—"Kite Ascension on Lake Constance (Boden-See)." Lake Constance lies on the confines between Germany and Switzerland and as its dimensions allow of a straight northwest and southeast course of nearly thirty miles in length with a free width of four or five miles it is one of the most convenient lakes in the world on which to acquire the necessary experience in flying kites from moving steamers. The flying of kites from vessels at sea for the purpose of carrying a life line to a lee shore has, of course, been practised for a long time, but the application of the kite and steamboat at sea to aerial research belongs to recent years. Hergesell states that his first experiments on Lake Constance were made on July 1, 1900, and were revived in 1902, continuing every month until the end of 1903, the expenses being borne mostly by the Meteorological Institute at Strassburg and afterwards by the German Empire and the Wurtemburg authorities combined. The Hargrave kites were employed; the best of steel wire of diameters 0.7, 0.8, and 0.9 millimeter was used. A reel similar to that which Professor Marvin constructed for use at Hamburg was used, but instead of winding the line by the use of a gas engine, workmen were employed at first until it was found that the highest velocity attainable, viz, one meter per second, did not suffice to protect the kite from injury when the wind died away or when the boat approached the shores of the lake, so that eventually an automobile motor of three and one-half horsepower was used and velocities up to five meters per second could then be attained. The boat from which the kite was flown had a length of about 50 feet, was driven by a fifteen horsepower gas motor, and could attain a speed of four and one-half meters per second. Evidently, therefore, in a calm or light wind the speed of the boat would not be sufficient to raise the kite; in fact it was found that in addition to this speed one must have a wind of 2.5 meters per second in order to succeed. In the latter part of the work a more powerful steamer was used which could attain a velocity of 6.7 meters per second, with which, in general, flights could be made successfully, except on days of absolute calm, on which occasions Hergesell says he resorted to the use of small captive balloons which, when held at a given altitude in the air and drawn horizontally by the movement of the boat, gave the thermograph a sufficient ventilation to attain good results. He advocates the establishment of a permanent observatory on the shore of Lake Constance, furnished with a boat, kites, and balloons in order to accomplish daily soundings in the free atmosphere. As to the actual observations made on Lake Constance, he gives the results of 34 kite ascensions during June-December, 1903; the previous ascents having already been published in the "Verœffentlichungen."

The highest kite ascent seems to have attained 2710 meters, so that there can be no doubt that this method of raising kites in calm weather is an important addition to our methods of research in meteorology, and is applicable not only on a long stretch of river or lake, but peculiarly so on any short line of railroad that may be available. In fact, the meteorologist who owns a first-class automobile may thus become independent of the wind, and of location as to land and water, and be able to explore the atmosphere in regions where, and at hours when it has hitherto been impracticable to use kites.

(2) *R. Assmann.*—"A Year of Simultaneous Kite Ascensions at Berlin and Hamburg." From a study of the work at these two stations almost daily from May, 1903, to April, 1904, the author draws many important conclusions. As inversions of temperature have occurred more frequently than European meteorologists anticipated [although by no means unexpected to those acquainted with American weather maps and climate.—ED.] the author enumerates them, and finds that 50 per cent of the ascensions from Berlin and about 38 per cent of the observations over Hamburg during the year revealed inversions, or uniformity, of temperature over the respective cities. The inversions were most frequent in November to March, and least frequent in the months May to August. The average altitude at which the inversions took place was rather higher in summer than in winter, and on the average of the year was 932 meters at Hamburg and 775 at Berlin. The occurrence of the inversions was most frequent when the areas of highest pressure were north and east of the stations or when the lowest pressures were south and west of the stations. The intensities of the inversions at both stations were parallel to each other, that is to say, the largest inversions in general occurred simultaneously at both stations. In general, it appeared that the wind brought the conditions favorable to inversion, and that therefore we have only to trace the air backward along the path of the wind in order to find the origin of the heat that is the prominent feature of the phenomenon of inversion. Following up this idea, the author discovered that he was almost invariably led backward on the path of the wind to a region of low temperature, instead of high temperature, and that his research could not be successful unless he studied, not the lowest, but the intermediate currents of air, lying between 500 and 1500 meters in altitude, a study that must be left to the near future. Having already suggested the possibility that the inversions occurring at considerable altitudes are due to heat given out at great distances by condensation of vapor taking place in air that subsequently floats over the station, Assmann finds the present investigation confirms this suggestion since the above-mentioned distribution of pressure implies a system of winds bringing moist air from distant lakes and oceans and from regions of rainfall.

(3) *A. de Quervain.*—"On the Determination of the Path of a Sounding Balloon during the International Ascension of July 2, 1903, from Strassburg." This is the first complete determination of the path of a small balloon up to its greatest height of 15,000 meters. In order to accomplish this, de Quervain used a theodolite whose telescope had a magnifying power of about sixteen times, a field of view of 1° 20′ diameter, and an object glass 42 mm. in diameter, such as is sold by Bosch in Strassburg for such purposes at a price of about $60. One observer remained continuously at the eyepiece of the telescope, since the balloon must be followed continuously for fear of some sudden change in its direction. This is quite wearisome to the eye but one accustomed to astronomical observation understands how to rest the eye. Whenever this observer had adjusted the cross wires in the field of view so as to precisely cover the balloon he gave the order "Attention, read," and then a second assistant read the azimuth circle and the time, while a third assistant read the altitude circle. In this way the readings required only a few seconds, the balloon was never lost sight of, and 120 positions were noted within the first two hours after which the balloon became invisible in the vapors near the horizon. The angular readings being plotted on a large scale afforded fixed points in the path of the balloon, between which the details were filled in with the meteorograph record. The horizontal projection of the path showed that up to 15,000 meters the air was very quiet with a gentle movement southward above 5000 meters, but a northward movement below that. Of course, as the balloon could not be followed to the very end

of its path, especially after it burst and fell, this method of observation does not help one much in searching for the place of descent of a balloon, but as a means of determining the horizontal movement of the air it is an invaluable addition to our knowledge since the ordinary, simple pressure and temperature records tell us nothing of this.

(4) *J. Maurer*.—"Experimental Investigation into the Coefficient of Sensitiveness or [Coefficient of Sluggishness] of Ventilated Thermometers for Various Pressures or Densities of the Air." As was well shown by Marvin, MONTHLY WEATHER REVIEW for October, 1899, the records of kite and balloon thermographs must be interpreted after a careful consideration of our knowledge of the rapidity with which the instrument responds to a change of temperature. In fact the sensitiveness of thermometers was first investigated experimentally by Poisson and an analogous investigation, in 1865, by the Editor will be found quoted in his "Treatise on Meteorological Apparatus and Methods;" it was also attended to in our balloon work of 1882–1885, but the vital importance of this subject to modern meteorology was perhaps not generally appreciated until the introduction of meteorographs, carried up rapidly by kites and balloons, since 1893. Doctor Maurer established his thermometers, or other temperature apparatus in tubes, through which a stream of air could flow at any given temperature, pressure, or velocity, and he was able to show that under these conditions the coefficient of sluggishness for a given constant velocity of wind increases very slowly as the pressure or density of the air diminishes to 400 mm., and then more rapidly until 60 or 80 mm.; it is nearly double its value at 726 mm. For different thermometers, spherical, cylindrical, and tubular, the value varies considerably. For all forms of self-registering thermometers the values are larger than for ordinary thermometers. The sluggishness varies with the kind of gas that is used, being least with hydrogen gas, whose coefficient of conduction is very large. A proper appreciation of the effect of sluggishness is necessary before we can understand whether the relatively high temperatures recorded by Assmann and Teisserenc de Bort at altitudes of 10 to 15 kilometers belong to the atmosphere or have their origin in the thermograph itself.

(5) *A. Sprung*.—"Photograph of a Rare Form of Cloud." The author gives a photographic print of a cloud seen May 25, 1904, at Potsdam, and the perfection of this print should stimulate other meteorologists to do as well. The cloud itself appeared at first as rain falling from an alto-cumulus, but the author seems to class it as a case of false cirrus formed from an alto-cumulus.

(6) *A. de Quervain*.—"Tables for the Barometric Computation of Altitudes." Both Angot and Rykatchef long since demonstrated that when barometric observations are made with sufficient accuracy the correspondingly accurate computation of altitudes can only be carried out by dividing the intervening air into layers, within which the gradients of temperature, moisture, and pressure, and for that matter also motion, follow some simple law. In other words, the atmosphere consists of a series of layers each of which is governed by special considerations, so that it will not do to assume average temperatures, moistures, etc., for the whole mass. The barometric formulæ and the tables for their use were first given with sufficient elaboration by Angot in the Memoirs of the Central Meteorological Bureau at Paris for 1896. Quervain has reprinted these with some modifications and extensions, adapting them to such pressures and temperatures as are likely to be met with in work with sounding balloons, viz, down to 20 mm. of pressure, and —60° C. He has also introduced the latest constant for the density of the air at the earth's surface as composed of nitrogen, oxygen, argon, and carbonic acid gas, but even this will evidently need reconsideration whenever in any special case the specific local and temporary constitution of the air can be determined. After all, however, accuracy in barometric hypsometry depends essentially upon our knowledge of the temperature of the air, and our determination of the existence or nonexistence of an inversion of temperature.

(7) "Proceedings of the Conference of the International Committee for Scientific Aerial Research at St. Petersburg in September, 1904." See MONTHLY WEATHER REVIEW, February, 1905, page 59.

(8) *H. H. Clayton*.—"Various Researches on the Temperature in Cyclones and Anticyclones in Temperate Latitudes." The author reviews the literature of the past 30 years developing the idea that areas of low pressure are regions of relative cold, and areas of high pressure regions of relative warmth; which ideas are the opposites of those that had been uniformly maintained before the establishment of mountain observatories and kite and balloon work. Doubt as to the correctness of the older ideas was perhaps first awakened in Germany by Professor Hann's discussion, in 1876, of observations on mountain peaks, and he started the idea that areas of high pressure had a dynamic origin, and were not due entirely to the cold of the lower strata and the consequent overflow of the upper air Since those days, the discussion as to the thermal origin and the dynamic origin of areas of high pressure has been kept up by Hann, Dechevrens, and Hazen, although it might well be recognized that both causes are operative and that the important question is as to which is the prevailing influence in any special case. Mr. Clayton says that up to 1904 the investigations of Hann, Dechevrens, Berson, and Teisserenc de Bort lead to the conclusion that below nine kilometers cyclones average colder than anticyclones, while the investigations of Harrington, Hazen, Rotch, Shaw, Dines, and himself lead to the conclusion that cyclones average warmer than anticyclones. These facts appear to indicate a direct contradiction, yet it may be, as in the case of the different results obtained by Espy and Redfield in regard to the wind movement in cyclones, that both are partly right.

On comparing the results by the two sets of investigations, one difference stands out distinctly. Those investigators who have found that the cyclone is colder than the anticyclone have considered the temperature in relation to pressure without regard to time, while the investigators who have found that the cyclone is warmer, have, with the exception of Mr. Rotch, considered the temperature with relation to the time of maxima and minima of pressure. Why these two methods should lead to different results it is difficult to see, although there may be a reason. Finally Mr. Clayton says:

> The cold-air cyclone of the upper air and the warm-air cyclone of the lower air are not necessarily connected, but both influence the surface pressure and both probably usually exist simultaneously in temperate zones within a few hundred kilometers of each other, and may form part of one system. Heretofore, in the convectional theories of cyclones the warm-air surface cyclone has been fully considered, but the upper-air cold cyclone has been neglected. These cold cyclones are usually secondaries, or V-shaped depressions circulating around the polar cold-air cyclone.

In order to explain the results of observations at Blue Hill Mr. Clayton states that he has adopted the hypothesis that there are two causes for areas of low pressure in the atmosphere: (1) an area of cold which contracts the air and tends to cause cyclonic circulation in the upper air, and (2) an area of warmth which expands the air and tends to cause cyclonic circulations in the lower air. In the first case the air tends to become denser and increase the pressure near the earth's surface, but the centrifugal force acting on the circulating upper air, to an unlimited extent, counteracts this effect. In the second case the upward expansion of the air tends to increase the pressure aloft, but to a limited extent, this is counteracted by the circulating air below.

(9) *H. Hergesell and E. Kleinschmidt*.—"On the Compensation of Aneroid Barometers for the Influence of Temperature."

As this is one of the most important and most difficult problems in observational meteorology it must continue to demand special attention by manufacturers, inventors, theoretical and experimental physicists, since numerous questions must be considered, and it will be a long time before highly accurate results can be obtained. As the authors say, the measurements of atmospheric pressure in sounding balloons make demands upon the aneroid barometer such as have never before been considered. The aneroid box must be free from errors over a range of more than 700 mm. in pressure and 80° C. in temperature, it must also be equally accurate for the most rapid and for the slowest changes. The present investigation considers only the influence of the temperature on the Bourdon pressure tube, with regard to which the authors state that no such tube has yet attained an absolute compensation, they also show that the ordinary method of compensation which was supposed to hold good for a pressure of 760 mm. is the worst possible for the barograph of a sounding balloon, as it introduces the largest errors at great altitudes. The special Bourdon tube, prepared by the authors' method for aerial research and especially adapted to balloon work, seems to reduce the error of compensation to a minimum. The authors also give a method of determining the correction to such a tube for any given pressure and temperature. Many of the tubes investigated by them showed during the first few months after manufacture very large changes in their indications, so that none should be used that have not had time to show their invariability.

(10) *K. Wegener.*—"A Study of the Simultaneous Kite Ascensions in Berlin, Germany, and Hald, Jutland, from the Summer of 1902 to the Spring of 1903." The station Hald is 530 kilometers northwest of Berlin and near Viborg. The observations at that place were made by a Franco-Scandinavian expedition conducted by Teisserenc de Bort, and the results of it are published in full by him. At the same time the Aeronautic Observatory of the Royal Prussian Institute began regular daily work at Berlin. This present study of the work at Berlin and Hald presents many features analogous to the study by Assmann of the observations at Berlin and Hamburg above summarized. Wegener finds a maximum number of inversions in the winter time, and for east winds, and for calms. The inversion layer was generally higher above Berlin than above Hald, and higher at both places in summer than in winter. The intensity of the inversion was greater above Berlin than Viborg, and greater in winter than in summer. The largest inversions occurred with southeast winds above Berlin, and with east winds above Hald. The statistical material seems to show a great horizontal extension of the inversion layer. In general, the velocity of the wind at every altitude was greater above Hald than above Berlin, or in other words, the retardation of the lowest stratum of air was greater at Berlin than at Hald. The greatest increase in velocity of the wind occurred between sea level and 500 meters; above this elevation at Hald there was a diminution of velocity, so that the average increase of wind velocity with altitude was less at Hald than at Berlin. The variation of wind direction with altitude was greatest in the lowest stratum and greater over Hald than above Berlin, but in the stratum between 500 and 1000 meters above Hald the change of the wind was in the opposite direction. Cases of great dryness of the air were more frequent over Berlin than over Hald. The average monthly changes of temperature were more uniform at 1000 meters above Hald, and the monthly range was less. The nearly circular area of low pressure of October 16, 1902, which belonged to those specially studied by von Bezold as so-called "centriert" depressions, or those from which air must be flowing outward at some special level above the ground was specially studied by Wegener, who found that the critical altitude in this case was 1100 meters, and that above this limit the air must be flowing outward, against the barometric pressure gradient.

(11) *H. Hergesell.*—"New Observations on the Meteorological Conditions of the Upper Warm Stratum of Air." This paper discusses especially the balloon ascension from Strassburg on the 9th of February, 1905, when an altitude of 15,080 meters was attained. The remarkably warm layer of air previously described by Assmann and Teisserenc de Bort as a result of their numerous voyages, as existing at and above eleven kilometers, but for the existence of which no satisfactory reason has yet been given, was again certainly met with on this occasion at an altitude of 11,400 meters, or about 30 minutes after the balloon had left the ground. Up to that point the ascending balloon had recorded a nearly regular adiabatic diminution of temperature which, however, now suddenly changed to an increase, although the rate of increase diminished with farther ascent. The same phenomena were observed in reverse order as the balloon fell, and it attained the lower limit of the warm stratum at 11,300 meters; the difference between the ascending and descending determinations is, therefore, only 100 meters and may have been largely due to the sluggishness of the thermograph. As soon as the rising balloon entered the warm layer it suddenly changed the direction and increased the velocity of its motion, so that the layer of warm air represented an entirely different current, whose azimuthal direction was 130° different from that of the lower one.

This summary of the first eleven articles in the Beiträge will suffice to show the nature of the problems presented by the new meteorology, and the solid physical basis on which the investigations are to be conducted; the periodical itself is bound to become a leading publication in physical meteorology.

HAILSTORM IN THE BAHAMAS.

A newspaper clipping from Miama, Fla., states that about April 18 the island of Spanish Wells, in the Bahamas 50 miles west of Nassau, was visited by a deluge of rain changing to hail. The hailstones ranged from one-fourth to one inch in diameter. This continued for several minutes until the ice was banked for several inches on the ground. Of course great damage was done to the crops. The residents of the Bahamas state that hailstorms were unknown but this present phenomenal fall is confirmed by several witnesses, indeed some state that the roofs of houses were covered six inches deep. A driving wind occurred during the hail.

We have held back this item until receiving confirmation from the cable operator at Nassau. The fall must have been very local as no hail was reported from any other island.

NO CHANGE OF CLIMATE.

The daily press is the great educator of the country and the MONTHLY WEATHER REVIEW hopes in a modest way to emulate its example. When we find popular errors that have permeated the human mind for centuries repeated and taught as it were *ex cathedra* by numerous newspaper correspondents we can but hope that these same papers will give to the public the best results of recent careful study, as in the following case:

In a syndicate letter of July 5, a special correspondent, Mr. William E. Curtis, shows that the western limit of the Kansas wheat belt has been pushed westward from the one hundredth meridian to the one hundred and second meridian, or about 100 miles without special irrigation and without any change in climate. He states that the extreme limits of cultivation have been as follows: in 1860, Emporia, 110 miles west of the Missouri State line; in 1870, Manhattan; in 1880, Salina, 286 miles west of the State line of Missouri; about 1890 there were "seven lean years" and many farms were abandoned, but